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PARK, EDWARD	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	**Application No.** 10/807,259	**Applicant(s)** WATANABE ET AL.	
	Examiner EDWARD PARK	**Art Unit** 2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _28 August 2008_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-8_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-8_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. This action is responsive to applicant's amendment and remarks received on 8/28/08. Claims 1-8 are currently pending.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. **Claims 1, 2, 3/1** are rejected under 35 U.S.C. 102(b) as being anticipated by Michael et al (US 6,421,458 B2).

Regarding **claim 1**, Michael discloses an image processing device for determining three-dimensional position and/or orientation of an object, comprising:

image data capturing means for capturing image data containing an image of the object (see figure 1a, numeral 100, col. 4, lines 31-45, imaging system 100);

reference model pattern creating means for creating a reference model pattern based on image data of a reference object with a three-dimensional reference orientation relative to said image capturing means captured by said image capturing means, said reference object having a shape substantially identical to that of the object (see fig. 2a, numeral 200, col. 4, lines 31-44; series of training images are captured of an object or plurality of objects 104, the same object may be presented at a range of positions and orientations relative to the imaging system 100, the training objects 104 comprise objects known to be representative samples so as to produce the most accurate statistics);

transformation means for performing two-dimensional and geometrical transformation on the created model pattern using a plurality of parameter sets to generate a transformed model pattern representing an image of the object with three-dimensional orientation different from the reference orientation (see fig. 2a, numeral 210, col. 4, lines 59-67, col. 5, lines 1-65; alignment model image 114 and each training image 101 are presented to an alignment system 106 for determining the affine pose 107 of each training image with respect to the alignment model image and uses the affine pose 107 comprises a set of parameters which describe how the training image can be transformed mathematically so as to align the training image with the alignment model image, each filtered training image 109 and its corresponding affine pose parameters 107 are applied to the General Affine Transform 110 to generate transformed training images 111, following transformation, a template image 113 is computed in step 212);

pattern matching means for performing a pattern matching of the image data of the object captured by said image capturing means with the transformed model pattern (see fig. 2b, numeral

234, col. 6, lines 35-67, col. 7, lines 1-8; generate a transformed image 311 which align substantially with the template images 113);

selecting means for repeatedly performing the generation of a transformed model pattern (see fig. 2a, numeral 216; col. 6, lines 8-20; a determination is made as to whether training is complete, if not additional training images may be captured) and the pattern matching of the image data of the object with the transformed model pattern to thereby select one of the transformed model patterns in conformity with the image data of the object, and obtain information on a position of the image of the object in the image data (see fig. 2b, numeral 234, col. 3, lines 5-10, col. 6, lines 35-67, col. 7, lines 1-8; process of transforming the filtered training and run-time images implies that the run-time process is executed more than once; generate a transformed image 311 which align substantially with the template images 113);

means for obtaining information on a position of the image of the object in accordance with the selected one of the transformed model patterns in the image data (see col. 3, lines 5-10, col. 6, lines 35-67, col. 7, lines 1-8; statistics on the area, position, and orientation of the labeled regions are computed);

means for obtaining information on the three-dimensional orientation of the object based on one of the parameter sets used for generating the selected one of the transformed model patterns (see col. 4, lines 7-18, col. 4, lines 66-67; col. 5, lines 1-17; affine parameters apply to six degrees of freedom to compensate for image scale, shear, rotation, skew, and translation assuming a two-dimensional image of a three-dimensional object); and

determining means for determining three-dimensional position and/or orientation of the object based on the information on the position of the image of the object in the image data and

information on the three-dimensional orientation of the object (see col. 3, lines 5-10, col. 6, lines 35-67, col. 7, lines 1-8, col. 5, lines 1-17; statistics on the area, position, and orientation of the labeled regions are computed; two-dimensional image of a three-dimensional object, the affine parameters apply to six degrees of freedom, to compensate for image scale, shear, rotation, skew and translation).

Regarding **claim 2**, Michael discloses an image processing device for determining three-dimensional position and/or orientation of an object, comprising:

image data capturing means for capturing image data containing an image of the object (see figure 1a, numeral 100, col. 4, lines 31-45, imaging system 100);

reference model pattern creating means for creating a reference model pattern based on image data of a reference object with a three-dimensional reference orientation relative to said image capturing means captured by said image capturing means, said reference object having a shape substantially identical to that of the object (see fig. 2a, numeral 200, col. 4, lines 31-44; series of training images are captured of an object or plurality of objects 104, the same object may be presented at a range of positions and orientations relative to the imaging system 100, the training objects 104 comprise objects known to be representative samples so as to produce the most accurate statistics);

transformation means for performing two-dimensional and geometrical transformation on the created model pattern using a plurality of parameter sets to generate a transformed model pattern representing an image of the object with three-dimensional orientation different from the reference orientation (see fig. 2a, numeral 210, col. 4, lines 59-67, col. 5, lines 1-65; alignment model image 114 and each training image 101 are presented to an alignment system 106 for

determining the affine pose 107 of each training image with respect to the alignment model image and uses the affine pose 107 comprises a set of parameters which describe how the training image can be transformed mathematically so as to align the training image the alignment model image, each filtered training image 109 and its corresponding affine pose parameters 107 are applied to the General Affine Transform 110 to generate transformed training images 111, following transformation, a template image 113 is computed in step 212);

storage means for storing the plurality of transformed model patterns and the parameter sets used in generating the respective transformed model patterns to be associated therewith (see figure 1a, numeral 112, col. 5, lines 39-53; transformed training images are preferably stored in a pair of accumulators 112);

pattern matching means for performing pattern matching of the image data of the object captured by said image capturing means with the plurality of transformed model patterns to thereby select one of the transformed model patterns in conformity with the image data of the object (see fig. 2b, numeral 234, col. 6, lines 35-67, col. 7, lines 1-8; generate a transformed image 311 which align substantially with the template images 113); and

means for obtaining information on a position of the image of the object in accordance with the selected one of the transformed model patterns in the image data (see col. 3, lines 5-10, col. 6, lines 35-67, col. 7, lines 1-8; statistics on the area, position, and orientation of the labeled regions are computed);

means for obtaining information on the three-dimensional orientation of the object based on one of the parameter sets used for generating the selected one of the transformed model patterns (see col. 4, lines 7-18, col. 4, lines 66-67; col. 5, lines 1-17; affine parameters apply to

six degrees of freedom to compensate for image scale, shear, rotation, skew, and translation assuming a two-dimensional image of a three-dimensional object); and

determining means for determining three-dimensional position and/or orientation of the object based on the information on the position of the image of the object in the image data and information on the three-dimensional orientation of the object (see col. 3, lines 5-10, col. 6, lines 35-67, col. 7, lines 1-8, col. 5, lines 1-17; statistics on the area, position, and orientation of the labeled regions are computed; two-dimensional image of a three-dimensional object, the affine parameters apply to six degrees of freedom, to compensate for image scale, shear, rotation, skew and translation).

Regarding **claim 3/1**, Michael teaches a two-dimensional and geometrical transformation of an affine transformation (see col. 4, lines 66-67; col. 5, lines 1-17), and said image processing device further comprises additional measuring means for obtaining a sign of inclination of the object with respect to said image capturing means (see col. 4, lines 66-67; col. 5, lines 1-17).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. **Claims 7 and 8** are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Michael et al (US 6,421,458 B2) in view of Watanabe et al (EP 1043689 A2).

Regarding **claims 7, 8**, Michael discloses all elements as mentioned above in claim 1. Michael does not disclose a storage means storing an operating orientation of the robot relative to the object or storing an operating orientation and an operating position of the robot relative to the object; and robot control means for determining an operating orientation of the robot or the operating orientation and an operating position of the robot based on the determined three-dimensional position and/or orientation of the object; and an image capturing means mounted on the robot.

Watanabe, in the same field of endeavor, teaches a storage means storing an operating orientation of the robot relative to the object or storing an operating orientation and an operating position of the robot relative to the object ("when a picking-up command is inputted …. three dimensional position/posture of the camera 20 on the world coordinate system at this image capturing position is outputted to the image processing apparatus 30"; Michael: paragraph [0040]); and robot control means for determining an operating orientation of the robot or the operating orientation and an operating position of the robot based on the determined three-dimensional position and/or orientation of the object ("robot controller 10 operates the robot to perform a pick-up operation …. based on the three-dimensional position/posture of the workpiece W (Step 210)"; Michael: paragraph [0044]); and an image capturing means mounted on the robot (Michael: figure 1, numeral 20).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Michael reference, to be incorporated into a robot system as suggested by Watanabe, to enhance inspection process by "demanding relatively less on system storage, and improv[ing] system speed and accuracy" (Michael: col. 2, lines 5-12).

6. **Claim 4** is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Michael et al (US 6,421,458 B2) with Maeda et al (US 2003/0161537 A1), and further in view of Inoue (US 2003/0161504 A1).

Regarding **claim 4**, Michael discloses all elements as mentioned above in claim 3. Michael does not teach dividing of a model pattern into at least two partial model patterns which are subject to the affine transformation to generate transformed partial model patterns, and pattern matching of the image data of the object with the transformed partial model patterns to determine most conformable sizes, and determines the sign of the inclination based on comparison of the sizes of the conformable partial model patterns with each other.

Maeda teaches a pattern matching of the image data of the object with the transformed model patterns to determine most conformable sizes, and determines the sign of the inclination based on comparison of the sizes of the conformable model patterns with each other (Maeda: figure 1, numeral 32).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Michael reference to determine the sign of the inclination based on comparison of the sizes of the conformable partial model patterns with each other as suggested by Maeda, to allow the imaging device to accurately identify "a three-dimensional object using images obtained by photographing the object in the various directions" (Maeda: paragraph [0004]).

The Michael with Maeda combination as applied above does not teach dividing of a model pattern into at least two partial model patterns which are subject to the affine transformation to generate transformed partial model patterns.

Inoue teaches dividing of a model pattern into at least two partial model patterns (Inoue: figure 2, numeral 302, 303), which are subject to the affine transformation ("affine transformation"; Inoue: paragraph [0107]) to generate transformed partial model patterns.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Michael with Maeda combination as applied above, to utilize partial model patterns as suggested by Inoue, to further "correctly classify the input image regardless of a fluctuation in illumination, and a state of occlusion" (Inoue: paragraph [0012]).

7. **Claim 5** is rejected under 35 U.S.C. 103(a) as being unpatentable over Michael et al (US 6,421,458 B2) in view of Okisu et al (US 6,806,903 B1).

Regarding **claim 5**, Michael discloses all elements as mentioned above in claim 3. Michael does not teach a measurement of distances from a displacement sensor separately provided in the vicinity of said image capturing means to at least two points on the object using the displacement sensor, and determines the sign of the inclination based on comparison of the measured distances.

Okisu teaches a measurement of distances from a displacement sensor separately provided in the vicinity of said image capturing means to at least two points on the object using the displacement sensor, and determines the sign of the inclination based on comparison of the measured distances ("measure distance to two separate portions of an object from the electronic camera, and calculate an angle of inclination θ based on measure two distances"; Okisu: col. 19, lines 54-57).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Michael reference to determine the sign of the inclination based on

comparison of the measured distances as suggested by Okisu, to allow the image processing device to properly focus with high degree of accuracy on the targeted object for image capturing.

8. **Claim 6** is rejected under 35 U.S.C. 103(a) as being unpatentable over Michael et al (US 6,421,458 B2) with Watanabe et al (EP 1043689 A2), and further in view of Maeda et al (US 2003/0161537 A1).

Regarding **claim 6**, Michael discloses all elements as mentioned above in claim 3. Michael does not teach additional pattern matching of image data of the object captured after said image data capturing means is slightly moved or inclined and determining the sign of the inclination based on judgment whether an inclination of image of the object becomes larger or smaller than the selected one of the transformed model patterns.

Watanabe, in the same field of endeavor, teaches an additional pattern matching of image data of the object captured after said image data capturing means is slightly moved or inclined ("camera may be moved parallelly in accordance with the position of the workpiece in the field of view of the camera"; Watanabe: paragraph: [0048]).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Michael reference to move the image data capturing means as suggested by Watanabe, to provide more training images to the classifier in order for a more robust collection of data to enhance the classifier for increased reliability of the system.

Maeda teaches additional pattern matching of image data of the object captured after said image data capturing means is slightly moved or inclined (see fig. 4) and determining the sign of the inclination based on judgment whether an inclination of image of the object becomes larger

or smaller than the selected one of the transformed model patterns (Maeda: figure 1, numeral 32).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Michael with Watanabe combination to determine the sign of the inclination based on judgment whether an inclination of image of the object becomes larger or smaller than the selected one of the transformed model patterns as suggested by Maeda, to allow the imaging device to accurately identify "a three-dimensional object using images obtained by photographing the object in the various directions" (Maeda: paragraph [0004]).

Response to Arguments

9. Applicant's arguments filed 8/28/08, in regards to claim 1, have been fully considered but they are not persuasive. Applicant argues that the Michael reference does not disclose performing 2-D and geometrical transformation on the crated model pattern to generate a transformed model pattern representing an image of the object with a 3-D orientation different from the reference orientation (see pg. 6, second paragraph). This argument is not considered persuasive since Michael discloses within fig. 2a, numeral 210, col. 4, lines 59-67, col. 5, lines 1-65; alignment model image 114 and each training image 101 are presented to an alignment system 106 for determining the affine pose 107 of each training image with respect to the alignment model image and uses the affine pose 107 comprises a set of parameters which describe how the training image can be transformed mathematically so as to align the training image with the alignment model image, each filtered training image 109 and its corresponding

affine pose parameters 107 are applied to the General Affine Transform 110 to generate transformed training images 111, following transformation, a template image 113 is computed in step 212. Therefore, Michael clearly discloses that the training image is transformed that has a 3-D orientation different from the reference orientation.

Applicant argues that the Michael reference has the training image and the alignment model image is not transformed in order to align with the alignment model image (see pg. 6, third paragraph). This argument is not considered persuasive since the Examiner acknowledges that the training image is transformed, but the training image is considered the reference model pattern which is transformed into a transformed model pattern that is different from the reference object pattern.

Applicant argues that the Michael reference does disclose pattern matching of the image data of the object with a transformed model pattern that is generated to represent an image of the object different from the reference orientation (see pg. 6, fourth paragraph). This argument is not considered persuasive since alignment of the template and threshold images is considered pattern matching since in order to align two objects a matching must be executed to displace the objects in an appropriate position/orientation.

Applicant argues that the Michael reference does not disclose repeatedly performing the generation of a transformed model pattern and the pattern matching of the image data of the object with the transformed model pattern to thereby select one of the transformed model patterns in conformity with the image data of the object (see pg. 6, fifth paragraph). This argument is not considered persuasive since Michael discloses the cited limitation in fig. 2a, numeral 216; col. 6, lines 8-20; a determination is made as to whether training is complete, if not

additional training images may be captured and fig. 2b, numeral 234, col. 3, lines 5-10, col. 6, lines 35-67, col. 7, lines 1-8; process of transforming the filtered training and run-time images implies that the run-time process is executed more than once; generate a transformed image 311 which align substantially with the template images 113. The cited Michael reference is equivalent to the cited limitation as seen above in the argument and rejection.

Applicant argues that the Michael reference does not disclose information on a position of the image of the object in accordance with a selected transformed model pattern in obtained or that information on the 3-D orientation of the object based on one of the parameter sets used for generating the selected transformed model pattern is obtained (see pg. 6, last paragraph, pg. 7, first paragraph). This argument is not considered persuasive since the Michael reference discloses the cited limitations within col. 3, lines 5-10, col. 6, lines 35-67, col. 7, lines 1-8; statistics on the area, position, and orientation of the labeled regions are computed and col. 4, lines 7-18, col. 4, lines 66-67; col. 5, lines 1-17; affine parameters apply to six degrees of freedom to compensate for image scale, shear, rotation, skew, and translation assuming a two-dimensional image of a three-dimensional object. The cited section is equivalent to the cited claim limitation since the limitation only brings in the concept of obtaining information on a position of the image of the object based on the transformed model pattern, which is clearly shown when an error image that is based off of the transformed model pattern produces information on the area, position and orientation of the labeled regions which are further computed to classify the object. The second concept is having information on the orientation of the object based on one of the parameter sets, not on the actual transformed model pattern, which is clearly disclosed by the cited section.

Applicant argues that Michael does not disclose determining 3-D position and/or orientation of the object based on the information on the position of the image of the object and the 3-D orientation of the object. This argument is not considered persuasive since the cited limitation only calls for determining 3-D position which is disclosed within col. 3, lines 5-10, col. 6, lines 35-67, col. 7, lines 1-8, col. 5, lines 1-17; statistics on the area, position, and orientation of the labeled regions are computed; two-dimensional image of a three-dimensional object, the affine parameters apply to six degrees of freedom, to compensate for image scale, shear, rotation, skew and translation.

Applicant argues cited limitations within claim 1 are not disclosed by the Michael reference (see pg. 7, second paragraph – pg. 8, first paragraph). This argument is not considered persuasive since the arguments have been addressed for the cited limitations as seen above in the argument section.

Regarding claim 3/1, applicant argues that the claim is allowable due to the dependency from claim 1 (see pg. 8, second paragraph). This argument is not considered persuasive since the claim 1 stands rejected and the arguments and rejection can be seen above. Applicant argues that Michael does not disclose the limitations of claim 3. This argument is not considered persuasive since the cited limitation is taught and can be seen above in the rejection of claim 3/1.

Regarding claims 4-8, applicant argues that the claims are allowable due to the dependency from claim 1 (see pg. 8, last paragraph). This argument is not considered persuasive since the rejection of claim 1 stands and the arguments and rejection can be seen above. Furthermore, applicant argues that the combination does not disclose claim 4. This argument is

not considered persuasive since the combination of Michael, Maeda, with Inoue disclose all the limitations as cited in claim 4 and can be seen above in the rejection of claim 4.

Conclusion

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to EDWARD PARK whose telephone number is (571)270-1576. The examiner can normally be reached on M-F 10:30 - 20:00, (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on (571) 272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Edward Park
Examiner
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